

WHAT IS CLAIMED IS:

- 1 1. A method of reducing the circuit failure caused by tungsten plug pulling out of an
2 apparatus comprising the steps of:
3 providing a substrate having a lower portion and a layer of selected material over said
4 lower portion, said selected material having a top surface;
5 defining an aperture in said selected material extending from said top surface toward said
6 lower portion;
7 depositing a layer of tungsten over said top surface of said layer of selected material, said
8 tungsten also filling said aperture;
9 polishing said tungsten layer to remove a top portion of said tungsten layer;
10 stopping said polishing so as to leave a reduced thickness of said tungsten layer; and
11 providing a contact area over at least a portion of said tungsten filled aperture, said
12 contact area in electrical contact with said tungsten filling said aperture.
- 1 2. The method of claim 1 wherein said aperture is a trench.
- 1 3. The method of claim 1 wherein said substrate further includes a conductive area covered
2 by said layer of selected material and wherein said aperture is a via extending through said layer
3 of selected material and said tungsten in said via is in electrical contact with said conductive
4 area.
- 1 4. The method of claim 1 wherein said reduced layer of tungsten remaining after polishing
2 is between 0.3 μm and 0.01 μm .

1 5. The method of claim 1 wherein said layer of selected material is one of a layer of a
2 dielectric material and a layer of insulating material.

1 6. The method of claim 1 further comprising the step of depositing a liner material in said
2 aperture and over said top surface of said selected material before depositing said layer of
3 tungsten.

1 7. The method of claim 3 wherein said contact area is made of a conductive material
2 selected from the group consisting of copper, aluminum and an alloy of copper and aluminum.

1 8. The method of claim 3 wherein said conductive area is made of a conductive material
2 selected from the group consisting of copper, aluminum and an alloy of copper and aluminum.

1 9. The method of claim 8 wherein said contact area is made of a conductive material
2 selected from the group consisting of copper, aluminum and an alloy of copper and aluminum.

1 10. The method of claim 6 wherein said liner material is selected from the group consisting
2 of tantalum, tantalum nitride, titanium, and titanium nitride.

1 11. A semiconductor structure having a tungsten plug with reduced pullout characteristics
2 comprising:

3 a substrate having a lower portion and a layer of selected material over said lower
4 portion, said selected material having a top surface and defining an aperture extending from said
5 top surface toward said lower portion;

6 a plug of tungsten filling said aperture;

7 a polished layer of tungsten integral with said tungsten plug and covering said top surface

8 of said layer of selected material; and
9 a contact area covering at least a portion of said aperture and in electrical contact with
10 said plug of tungsten.

1 12. The semiconductor structure of claim 11 wherein said aperture is a trench.

1 13. The semiconductor structure of claim 11 further comprising a conductive area in said
2 lower portion of said substrate and covered by said layer of selected material and wherein said
3 aperture is a via extending through said layer of selected material such that said plug of tungsten
4 is in electrical contact with said conductive area and creates an electrical path between said
5 conductive area and said contact area.

1 14. The semiconductor structure of claim 11 wherein said polished layer of tungsten is
2 between about 0.3 μm and 0.01 μm .

1 15. The semiconductor structure of claim 11 wherein said selected material is selected from a
2 semiconductor material and an insulating material.

1 16. The semiconductor structure of claim 11 further comprising a liner material between said
2 plug of tungsten filling said aperture and said selected material.

1 17. The semiconductor structure of claim 11 wherein said conductive area is made of a
2 conductive material selected from the group consisting of copper, aluminum and an alloy of
3 copper and aluminum.

1 18. The semiconductor structure of claim 11 wherein said contact area is made of a
2 conductive material selected from the group consisting of copper, aluminum and an alloy of
3 copper and aluminum.

1 19. The semiconductor structure of claim 18 wherein said conductive area is made of a
2 conductive material selected from the group consisting of copper, aluminum and an alloy of
3 copper and aluminum.

1 20. The semiconductor structure of claim 16 wherein said liner layer is selected from
2 tantalum, tantalum nitride, titanium and titanium nitride.